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A review of the Recent Trochini of New Zealand (Mollusca: Gastropoda: Trochidae)

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Abstract

New Zealand Recent Trochini are revised, illustrated and keyed. Eleven species are recognised, including four new species of *Thoristella*. A new subgenus of *Trochus* is introduced for *Trochus camelophorus* Webster, 1906. The following taxa are newly synonymised with *Thoristella chathamensis* (Hutton, 1873): *Trochus oppressus dunedinensis* Suter, 1897, *Calliostoma aucklandicum* E.A. Smith, 1902 and *Thoristella chathamensis cookiana* Powell, 1934. *Trochus carmesina* Webster, 1908 is transferred from *Talopena* to *Thoristella*, and *Thoristella fossilis* Finlay, 1926 is transferred to *Trochus (Coelotrochus)*. Lectotypes are designated for *Trochus tiaratus* Quoy and Gaimard, 1834, *Trochus viridis* Gmelin, 1791, *Polydonta viridescens* A. Adams, 1853, *Polydonta elegans* Gray, 1835, *Polydonta tuberculata* Gray, 1843, *Trochus fulvolabris* Hombron and Jacquinot, 1854, and *Calliostoma aucklandicum* E.A. Smith, 1902.

Key words: Recent, New Zealand, Mollusca, Gastropoda, Trochidae, Trochini, *Trochus*, *Thoristella*, lectotypes, new taxa.

Introduction

Trochus and *Thoristella* species are common and significant components of the New Zealand marine biota. All live on hard substrata with the exception of *Trochus tiaratus* Quoy and Gaimard, 1834, which may also live on mud and sand. Judging from gut contents most if not all appear to be detritivores. Whereas the New Zealand *Trochus* and *Clanculus* species are well known, *Thoristella chathamensis* (Hutton, 1873) has been subdivided into a number of geographic and a "bathymetric" subspecies that prove to be untenable, and the affinities of *Thoristella carmesina* (Webster, 1908) have been obscured through misplacement in *Talopena*. The present contribution includes discussions of the affinities of these taxa, and descriptions of four new Recent species of *Thoristella*.

Abbreviations and text conventions:

AIM - Auckland Institute and Museum;
AMS - Australian Museum, Sydney;
BMNH - The Natural History Museum, London;
MNHN - Muséum National d'Histoire Naturelle, Paris;
NMNZ - Museum of New Zealand Te Papa Tongarewa, Wellington;
NZGS - Institute of Geological and Nuclear Sciences, Lower Hutt.

Height dimension precedes width in all references to shell measurements. All material is at NMNZ unless specified (registration numbers preceded by "M.").

Systematics

Superfamily **TROCHOIDEA** Rafinesque, 1815
Family **TROCHIDAE** Rafinesque, 1815
Subfamily **TROCHINAE** Rafinesque, 1815
Tribe **TROCHINI** Rafinesque, 1815
Genus **Trochus** Linnaeus, 1758.

Trochus Linnaeus, 1758: 756.
Type species (by subsequent designation of Iredale, 1912: 225): *Trochus maculatus* Linnaeus, 1758; Recent, tropical Indo-Pacific.

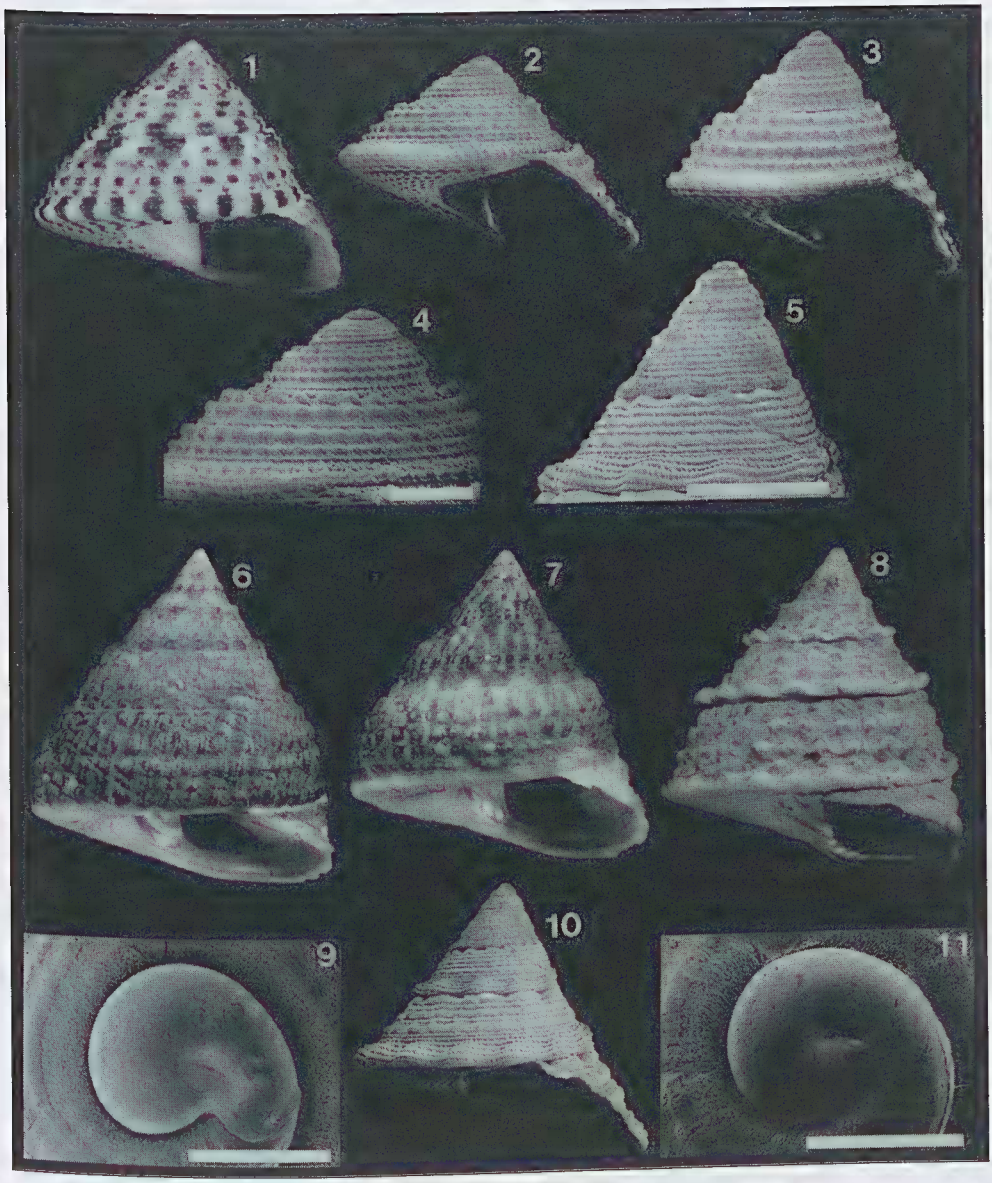
Remarks: Division of *Trochus* into well-defined subgenera is problematic (Herbert, 1993). In tropical and subtropical Indo-Pacific species currently referred to *Trochus* (s. str.) the columella edge may be smooth or dentate, there may be one or more spiral cords within the umbilicus, and the periphery may be stellate or smooth. The degree of development of axial lamellae is interspecifically variable.

All species examined currently referred to *Trochus, Coelotrochus* Fischer, 1879, *Infundibulops* Pilsbry, 1889, *Thorista* Iredale, 1915 and *Thoristella* Iredale, 1915 have essentially similar radulae, and the only major dichotomy in external anatomy that I am able to detect is the relatively larger cephalic tentacles in *Thoristella* species. Hickman and McLean (1990) have suggested that *Coelotrochus, Thorista* and *Thoristella* should perhaps be treated as discrete genera, but this seems difficult to justify for *Coelotrochus* and *Thorista,* which have traditionally been treated as subgenera of *Trochus* (Thiele, 1929; Wenz, 1938; Keen, 1960). *Thoristella* is interpreted as a genus for the endemic New Zealand radiation of small species, which are presumably derived from *Trochus.* A new subgenus of *Trochus* is introduced for *Trochus camelophorus* Webster, 1906.

Subgenus **Coelotrochus** Fischer, 1879

Coelotrochus Fischer, 1879: 417.
Type species (by monotypy): *Trochus tiaratus* Quoy and Gaimard, 1834; Recent, New Zealand.
Neozelandia Cossmann, 1918: 220.
Type species (by original designation): *Trochus tiaratus* Quoy and Gaimard, 1834; Recent, New Zealand.

Remarks: Herbert (1993) placed the southern African species *T. nigropunctatus* Reeve, 1861, and *T. cariniferus* Beck in Reeve, 1842 in subgenera *Trochus* and *Infundibulops* respectively, the latter differing primarily in lacking spiral cords within the umbilicus. Both of these species resemble the type species of *Coelotrochus* in shape and in that the periphery is not stellate, *T. nigropunctatus* also having strongly developed axial lamellae. Whether or not one or both of these southern African species belongs in *Coelotrochus* is unclear, but it is possible that the combination of non-stellate periphery and well-developed axial lamellae may be the only shell character states diagnostic of the subgenus.



Figures 1-11.
Shells of *Trochus* species. **1-4, 9.** *T. tiaratus* Quoy and Gaimard. **1.** Whangaroa Harbour, main channel opposite Kopumiti Point, 15-9 m, M.35329 (13.4 x 15.6 mm). **2,4** (juvenile),**9** (protoconch). Rangaunu Bay, 23 m, M.127373 (4.30 x 7.20 mm). **3.** Sportsman's Cove, Dusky Sound, Fiordland, 15 m, M.58940 (5.00 x 6.70 mm). **5-8,10,11.** *T. viridis* Gmelin. **5,10.** Juvenile, Otanerau Bay, East Bay, Arapawa Island, Queen Charlotte Sound, 20-29 m, M.50859 (7.00 x 8.60 mm). **6.** Tryphena, Great Barrier Island, littoral, M.90778 (25.5 x 23.0 mm). **7.** Timaru breakwater, littoral, M.5307 (19.0 x 17.0 mm). 8. Horseshoe Bay, Stewart Island, beach, M.130014 (25.5 x 23.0 mm). **11.** Protoconch, Whangaroa Harbour entrance, main channel, 20 m, M.41100. Scale bars 4, 5 = 1 mm, others = 170 μm.

Trochus (Coelotrochus) tiaratus (Quoy and Gaimard, 1834)
(Figs 1-4, 9, 12)

Trochus tiaratus Quoy and Gaimard, 1834: 256, pl. 64, fig. 6-11; Kiener, 1850: pl. 22, fig. 2; Philippi, 1855: 280, pl. 41, fig. 5; Fischer, 1875: 90, pl. 22, fig. 2; Pilsbry, 1889: 42, pl. 12, fig. 72-74.
Polydonta elegans Gray, 1835: 309; Gray, 1843: 238; Gray, 1856: 468.
?Trochus delicatulus Philippi, 1846: 105; Philippi, 1851: 176, pl. 28, fig. 1.
Polydonta tiarata.- Hutton, 1873: 36.
Trochus (Coelotrochus) tiaratus.- Fischer, 1879: 417; Hutton, 1884: 358; Finlay, 1926: 349, 369; Wenz, 1938: 312, fig. 694; Powell, 1979: 58, pl. 17, fig. 2.
Anthora tiarata.- Hutton, 1880: 94; Hutton, 1882: 165, pl. 7, fig. n.
Anthora conica Hutton, 1883b: 411.
Trochus conicus.- Hutton, 1893: 68, pl. 8, fig. 73a, b.
Trochus chathamensis.- Hutton, 1893: 69, pl. 8, fig. 74a-c (not Hutton, 1873).
Trochus (Infundibulum) tiaratus.- Suter, 1897: 260; Suter, 1913: 109, pl. 39, fig. 2.
Chlorostoma (Neozelandia) huttoni Cossmann, 1918: 220, pl. 7, fig. 35, 36. Replacement name for *Trochus conica* (Hutton, 1883) not Donovan, 1804.
Trochus huttoni.- Finlay, 1924: 99.
Trochus (Coelotrochus) huttoni.- Finlay, 1926: 349, 369; Powell, 1946: 64; Powell, 1957: 86; Powell, 1962: 78.
Coelotrochus huttoni.- Finlay, 1928: 237.

Type data:
Trochus tiaratus: Lectotype (the originally figured specimen here selected 15.5 x 17.5 mm) and 7 paralectotypes MNHN, "Nouvelle Zélande";
Polydonta elegans: Lectotype (here selected 15.0 x 18.0 mm) BMNH 1996020/1 and 5 paralectotypes BMNH1996020/2-6, "New Zealand";
Trochus delicatulus: Repository unknown, "Oceano Pacifico";
Anthora conica: Holotype Canterbury Museum, Christchurch M2746, Wanganui (Pleistocene).

Other material examined: Several thousand specimens in 100 lots NMNZ.

Distribution: (Fig. 12). Pleistocene (Castlecliffian) to Recent: North, South and Stewart islands, New Zealand, 0-220 m; taken alive at low tide to 40 m on hard or soft substrata.

Remarks: Among New Zealand *Trochus* and *Thoristella* species, *Trochus tiaratus* is characterised by large size (width up to 21 mm), weakly convex teleoconch whorls, gradate spire, non-stellate periphery, finely nodular spiral cords, crowded axial lamellae, deep umbilicus, and lack of umbilical spiral cords. The shell is typically wider than high, occasionally slightly higher than wide. The shell is typically variably spotted and/or irregularly axially banded brown on a paler or white ground, or the last few whorls may be rather uniform brown with paler spots. The few specimens seen from Fiordland (Dusky Sound, empty shells from mud, 15 m, NMNZ M.58940) are unusual in being very darkly

pigmented (stained?) and in that the adapical spiral on the earliest teleoconch whorls vanishes at an early stage of growth so that there are only three primary spiral cords above the peripheral pair (Fig. 3). On the penultimate whorl in adults from elsewhere there are typically four or five primary spiral cords above the peripheral pair, the latter typically surmounting a peripheral bulge, with the addition of varying numbers of secondary spirals that multiply by intercalation.

T. tiaratus evidently originated from the more finely sculptured Late Pliocene (Nukumaruan) species *Coelotrochus browni* Fleming, 1943. The Early Miocene (Altonian) species *Thoristella fossilis* Finlay, 1926 (originally interpreted as a subspecies of *T. chathamensis*), is much closer to *T. browni* and *T. tiaratus* than to any living species of *Thoristella*, and is here referred to *Trochus (Coelotrochus)*. Another member of the same lineage is *Trochus bibaphus* Bartrum and Powell, 1928 (Early Pliocene, Opoitian).

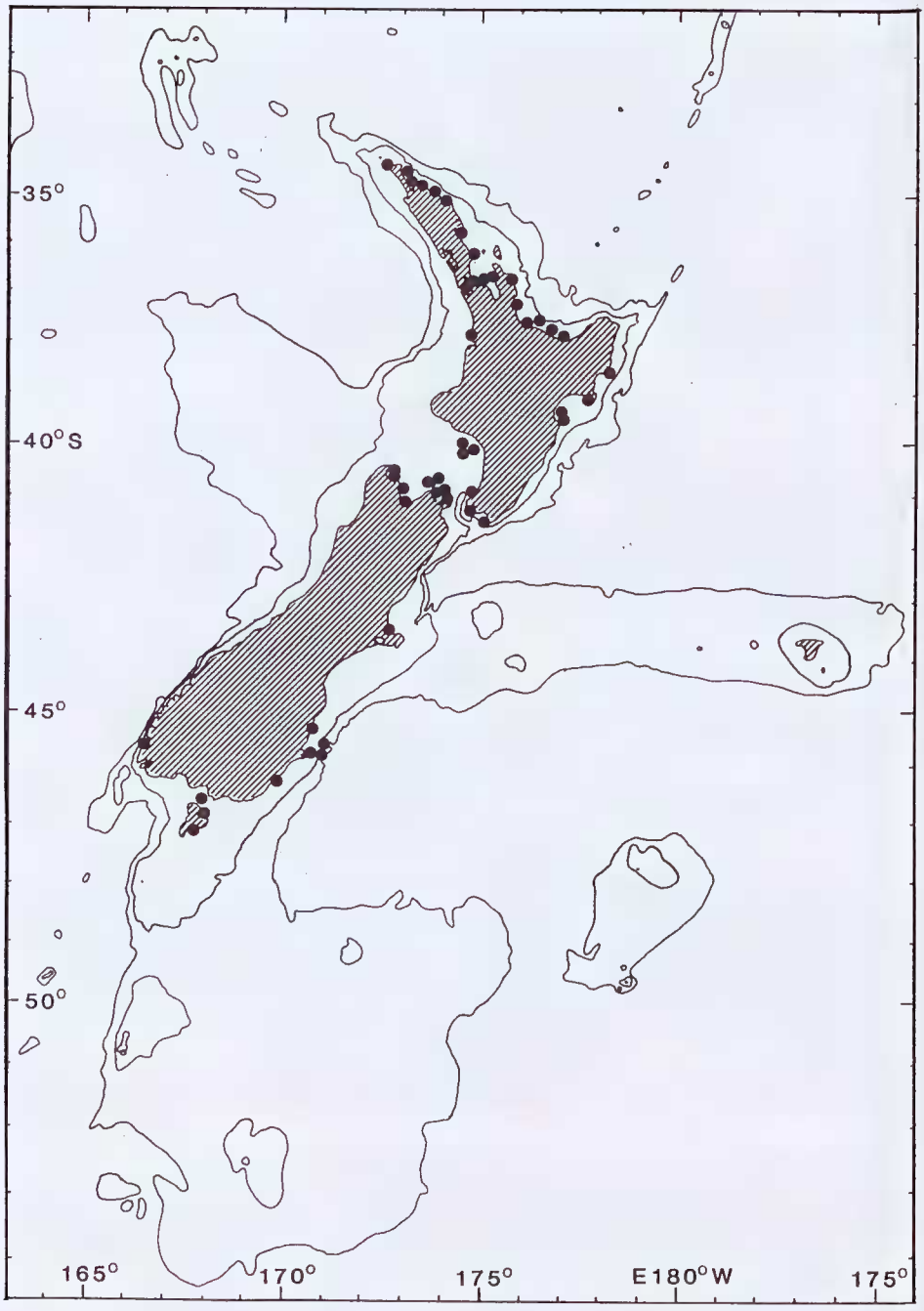
Subgenus **Thorista** Iredale, 1915

Anthora Gray, 1857: 148.
Type species (by monotypy): *Polydonta tuberculata* Gray, 1843 = *Trochus viridis* Gmelin, 1791; Recent, New Zealand. Not *Anthora* Doubleday, 1844.
Thorista Iredale, 1915: 436. Replacement name for *Anthora* Gray, 1857, not Doubleday, 1844.

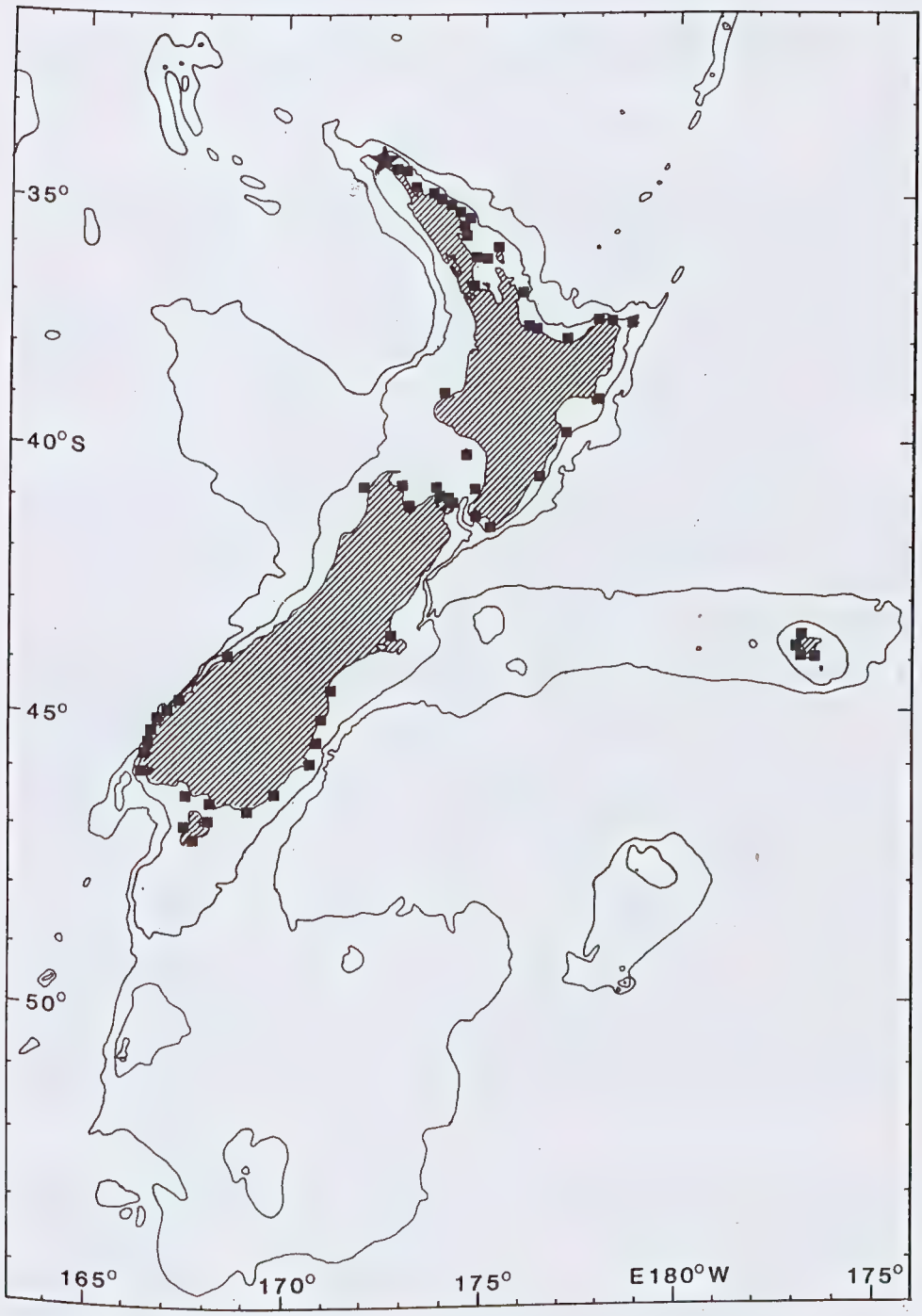
Remarks: The type species of *Thorista* Iredale, 1915 has a stellate periphery, two umbilical spiral cords in adults, and axial lamellae that are intermediate in development between those in *Trochus maculatus* and *T. tiaratus*.

Trochus (Thorista) viridis (Gmelin, 1791)
(Figs 5-8, 10, 11, 13)

Chemnitz, 1781: 97, figs. 1643, 1644.
Trochus viridis Gmelin, 1791: 3572 (based on Chemnitz, 1781, figs 1643, 1644); Philippi, 1848: 47, pl. 10, fig. 9, 10, pl. 16, fig. 7-9; Reeve, 1861: pl. 14, fig. 79a, b; Hutton, 1873: 35; Fischer, 1878: 305, pl. 97, fig. 2; Pilsbry, 1889: 43, pl. 3, fig. 16, 17; Hutton, 1884: 358; Cernohorsky, 1974: 148, fig. 5.
Polydonta tuberculata Gray, 1843: 239; Hutton, 1873: 36;
Trochus acinosus Gould, 1849: 92; Gould, 1852: 179, fig. 217a-c.
Polydonta viridescens A. Adams, 1853: 154 (based on Chemnitz, 1781, figs 1643, 1644).
Trochus fulvolabris Hombron and Jacquinot, 1854: 56, pl. 14, fig. 14, 16.
Polydonta (Infundibulum) tritonis A. Adams, 1855: 132.
Anthora tuberculata - Gray, 1857: 148; Hutton, 1878: 31; Hutton, 1880: 93; Hutton, 1883a: 124, pl. 14, fig. k.
Trochus (Anthora) tuberculatus.- Smith, 1874: 4, pl. 1, fig. 6.
Anthora viridis.- Hutton, 1880: 94.
Anthora tritonis.- Hutton, 1880: 94.
Trochus (Anthora) viridis.- Hutton, 1884: 358.
Trochus (Infundibulum) viridis.- Suter, 1897: 261; Suter, 1913: 110, pl. 8, fig. 9.



Figures 12
Map of New Zealand region showing distributions of *Trochus* and *Thoristella* species. 200 and 1000 metre contours indicated. **12.** *Trochus tiaratus* Quoy and Gaimard.



Figures 13.
Map of New Zealand region showing distributions of *Trochus* and *Thoristella* species. 200 and 1000 metre contours indicated. **13.** *Trochus viridis* Gmelin (■), and *Thoristella rex* n. sp. and *T. polychroma* n. sp. (★).

Trochus (Thorista) viridis.- Iredale, 1915: 436; Finlay, 1926: 349, 369; Wenz, 1938: 312, fig. 695; Powell, 1979: 58, pl. 17, fig. 1.
Thorista viridis.- Finlay, 1928: 237.
NOT *Trochus viridis* W. Wood, 1828: 17, pl. 6, fig. 36 = *Diloma subrostrata* (Gray, 1835).

Type data:
Trochus viridis and *Polydonta viridescens*: Lectotype (here designated) the syntype illustrated by Cernohorsky (1974, fig. 5), unlocalised = New Zealand;
Polydonta tuberculata: Holotype BMNH 1842.5.17.92, "New Zealand";
Trochus acinosus: Holotype USNM 5617, "New Zealand";
Trochus fulvolabris: Lectotype (the originally figured specimen here selected, 22 x 20 mm) and 2 paralectotypes MNHN, "Nouvelle-Zélande";
Polydonta tritonis: Lectotype (here selected, 23.0 x 22.5 mm) BMNH 1961148/1 and 2 paralectotypes BMNH 1961148/2-3, "New Zealand".

Other material examined: >500 specimens in 132 lots NMNZ.

Distribution: (Fig. 13). Late Pliocene (Nukumaruan)?, Pleistocene (Castlecliffian) to Recent: North, South, Stewart and Chatham Islands, New Zealand, 0-83m; taken alive intertidally to 64 m from hard substrata.

Remarks: *Trochus viridis* is characterised by large size (height up 28 mm), stellate periphery, two spiral cords on the umbilical wall, and distinctive sculpture of spiral threads, and interstitial axial lamellae with the addition on the spire of four rows (including periphery) of strong rounded nodules. A fifth row of nodules may appear between the peripheral and adjacent spire spiral on the last whorl in adults. The peripheral nodules commence near the start of the fourth teleoconch whorl and rapidly enlarge, the three adapical rows of nodules enlarge more slowly to eventually resemble the peripheral ones. The shell may be higher than wide or wider than high at maturity. The spire in subadult specimens is evenly conical or weakly coeloconoid, becoming cyrtoconoid at maturity. The peripheral flange becomes moderate to strong in subadult specimens then typically weakens and is absent from the last one or two whorls in adults. The peripheral flange persists onto the last adult whorl on specimens from the south-eastern South Island and Stewart Island (Fig. 8), and is exceptionally strong and persistent on specimens from the Chatham Islands, which also attain the largest size. Specimens from Lyttelton and Timaru are more finely nodular than those from elsewhere in the country (Fig. 7).

This or a closely similar species is known by a fragmentary specimen from the Nukumaru Brown Sands, Wanganui (Late Pliocene, Nukumaruan) (NMNZ M.127390).

The syntypes of *Trochus fulvolabris* Hombron and Jacquinot, 1854, are closely accordant with specimens from Lyttelton, and they were probably obtained there or at nearby Akaroa, which was visited by the Astrolabe in 1840. Not having seen the specimens first hand, I am unable to suggest where in New Zealand the type specimens of *T. viridis* might have come from, though they were certainly not from the Chatham Islands or Stewart Island.

From examination of the holotype (BMNH 196705), *Trochus viridis* W. Wood, 1828 (Wood, 1828, p. 17, pl. 6, fig. 36) is the New Zealand species *Diloma subrostrata* (Gray, 1835). Although this overlooked synonym has seniority, Gray's name must stand as Wood's is preoccupied by that of Gmelin, 1791.

Camelotrochus n. subgen. (of **Trochus**)

Type species: *Trochus camelophorus* Webster, 1906; Recent, northern New Zealand.

Diagnosis: Spire whorls sculptured with strong spiral cords crossed by strong imbricating axial lamellae, periphery not stellate. Umbilical wall with strong spiral cord.

Description: As for the type species (see below).

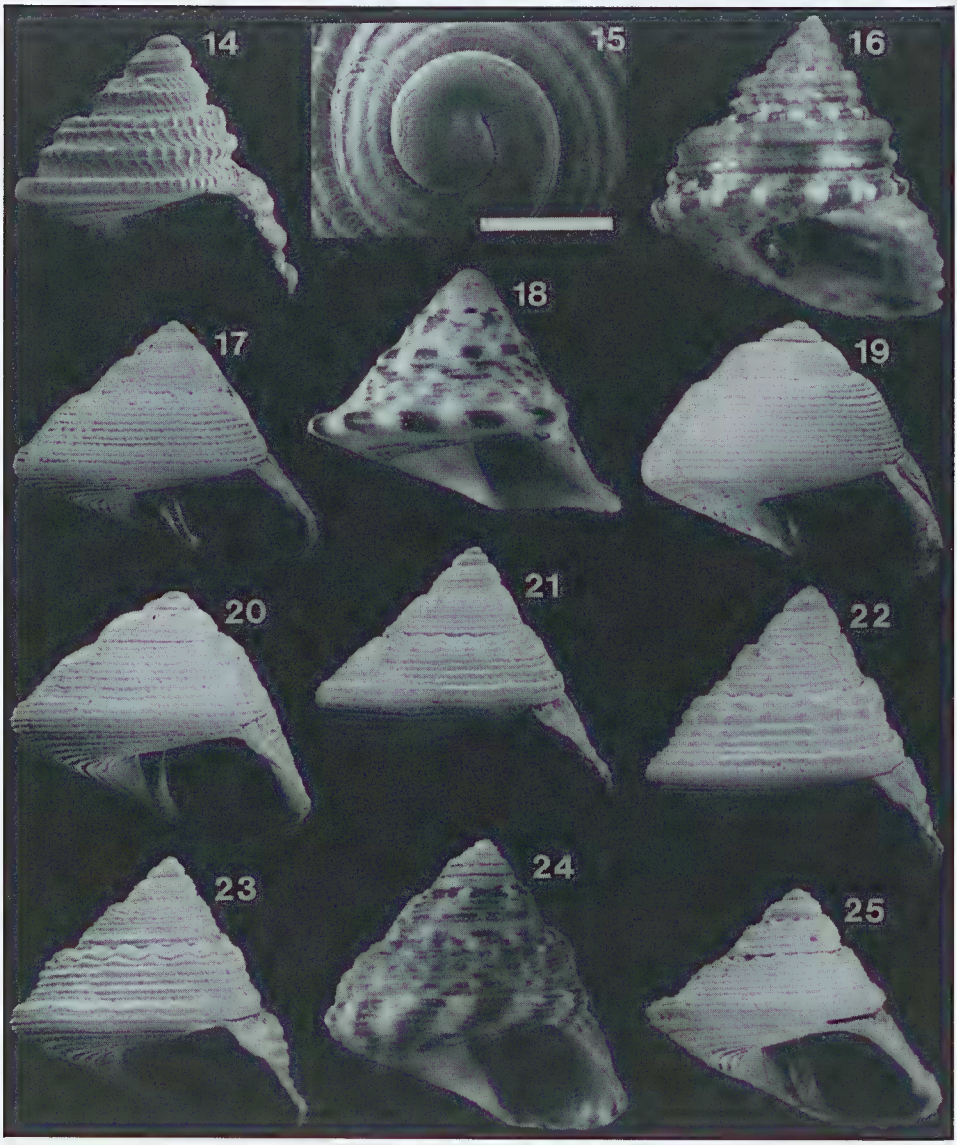
Remarks: *Trochus camelophorus* is characterised by a unique combination of characters and character states *(Diagnosis)*, and cannot be grouped in any genus group within Trochidae. It resembles the type species of *Thorista* and species of *Trochus* Linnaeus, 1758 in having a spiral cord on the umbilical wall, but differs in having fewer spiral cords on the spire, and stronger imbricating axial lamellae that entirely traverse the spire whorls, including the summits of the spiral cords. The spiral cords on the spire in *Thorista* and *Trochus* species have rounded nodules, and axial lamellae (where present) are finer, more crowded and confined to the spiral interspaces.

Etymology: From the Greek *kamilos* (rope) and the generic name *Trochus*

Trochus (Camelotrochus) camelophorus (Webster, 1906)
(Figs 14-16, 38)

Trochus camelophorus Webster, 1906: 309, pl. 39, fig. 1, 1a
Trochus conus.- Suter, 1906: 323 (not Gmelin, 1791).
Trochus (Infundibulum) camelophorus.- Suter, 1913: 110, pl. 33, fig. 3.
Trochus (Thorista) camelophorus.- Iredale, 1915: 436; Finlay, 1926: 369; Powell, 1979: 58, pl. 17, fig. 3.

Description: Shell up to 13 mm wide, about as wide as high, rather evenly conical, umbilicus filled by columella that is inserted on umbilical wall. Protoconch white. First 1.5 teleoconch whorls traversed by evenly spaced arcuate axial bands on pinkish white ground. Subsequent whorls with irregular axial maculations on white or pinkish white ground, maculations predominantly pink or red, some or all maculations on occasional specimens brown, or olive on and between median 2 spire spirals and pink or red above and below them; adult base white or cream, basal spiral cords spotted red or brown. Umbilicus porcellanous white or with a pinkish flush.



Figures 14-25.
Shells of *Trochus* and *Thoristella* species. **14-16.** *Trochus camelophorus* Webster. 14 (juvenile),15 (protoconch). Southeast Bay, Great Island, Three Kings Islands, 55 m, M.33835 (3.50 x 3.90 mm). **16.** Cape Maria van Diemen, beach, M.131604 (9.50 x 9.00 mm). **17-25.** *Thoristella chathamensis* (Hutton). **17.** Kaingaroa, Chatham Islands, littoral, M.12418 (4.60 x 6.30 mm). **18.** Chatham Islands, beach, M.16387 (6.10 x 8.25 mm). **19.** Kapiti Island, littoral, M.7114 (3.90 x 4.95 mm). **20.** Two Thumb Bay, Fiordland, 15 m, M.127294 (3.65 x 4.70 mm). **21.** Dusky Sound, Fiordland, 55m, M.10053 (5.00 x 5.80 mm). **22.** Off Otago Heads, 220 m, M.66845 (5.20 x 5.60 mm). **23.** Nugget, Halfmoon Bay, Stewart Island, littoral, M.64613 (5.90 x 6.75 mm). **24.** Golden Bay, Stewart Island, littoral, M.64176 (7.20 x 7.75 mm). **25.** Easy Harbour, Stewart Island, 7-20 m, M.27124 (4.40 x 5.50mm). Scale bar 15 = 330 μm.

Protoconch 350 μm wide, smooth, tip tightly pinched. Teleoconch of up to 6 whorls, periphery angulate, whorls inserted against base of peripheral spiral, base weakly convex, sculptured with rounded spiral cords and imbricating collabral axial lamellae. First 1.5 whorls convex, next whorl medially angulate, subsequent whorls flat-sided below concave subsutural ramp. Spire with 5 primary spiral cords that commence immediately, abapical 2 coalescing on third whorl, becoming fully fused on fourth whorl to form peripheral spiral, which is broadest, others similar to each other; 2 secondary spirals appearing on penultimate or last adult whorls in interspaces of abapical 3; 6 or 7 on base narrower than on spire, narrower towards umbilicus. Spire spirals smooth, similar and regularly spaced on first 2 whorls; on third whorl becoming nodular then lamellate with appearance of axial sculpture, and abapical third spiral descending abapically, adapical 2 spirals thereafter closest throughout. Axial lamellae commencing on third whorl, entirely traversing spirals and interspaces, strong on spire, much finer and more crowded on base. Umbilicus invaded by columella, rim undercut; wall with single, strong, smooth spiral cord, summit flattened, medially grooved in some specimens, outer side undercut, inner side almost vertical; deeply concave between cord and rim and cord and columella. Columella thick, strongly so adapically, oblique, protracted from insertion to low rounded adapical swelling, straight abapically. Aperture subtrapezoidal, simple; outer lip thin at rim, thickened within, strongly so abapically; parietal inductura thick at maturity.

Type data: Holotype AIM AK70776, Cape Maria van Diemen, beach drift.

Other material examined: 126 specimens in 23 lots NMNZ.

Distribution: (Fig. 38). Off Three Kings Islands, Cape Maria van Diemen, Whangaroa, off White Island, and Ranfurly Bank, East Cape; northern New Zealand, 0-228 m; taken alive at 50-76 m on Ranfurly Bank, East Cape (71-76 m, 1 live juvenile with 40 empty shells, NMNZ M.127364; 50-72 m, 1 subadult M.96247). Precise habitat unknown though certainly rocky ground and probably deep under boulders.

Remarks: *Trochus (Camelotrochus) camelophorus* is highly distinctive in its strong spiral sculpture, the relatively strong imbricating axial lamellae, and the single strong spiral cord within the umbilicus.

Genus **Thoristella** Iredale, 1915

Thoristella Iredale, 1915: 436.
Type species (by original designation): *Polydonta chathamensis* Hutton, 1873; Recent, New Zealand.

Remarks: Species of *Thoristella* attain smaller shell size (width up to 11mm) and have relatively larger cephalic tentacles than the type species of *Trochus*, *Coelotrochus* and *Thorista*, lack umbilical spiral cords, and have axial lamellae

similar to those in *T. viridis*. The periphery varies in shape from stellate to non-stellate in the type species, but is never stellate in the others. The strong similarity between adult *Thoristella chathamensis* and juvenile *Trochus (Thorista) viridis*, suggests close relationship between *Thoristella* and *Thorista*, and that one group is derived from the other by a paedomorphic process (polarity unclear). Note in this respect that the first umbilical spiral cord in *Trochus (Thorista) viridis* does not commence until the shell is about 10mm wide, suggesting that cord development in adult *Thoristella* species is retarded. The earliest known representative is an unnamed Early Miocene (Waitakian) species from Brydone, Southland reported by Beu and Maxwell (1990), and the group is endemic to New Zealand. The protoconch in all but one of the *Thoristella* species has a tightly pinched tip as in *Trochus (Thorista) viridis* and *T. (Coelotrochus) tiaratus*, the exception being *T. polychroma* n. sp., which has a bulbous tip.

Thoristella crassicosta Powell, 1937, from off the Three Kings Islands, is type species of *Acremodonta* B.A. Marshall, 1983, and belongs in Trochaclididae Thiele, 1929 (Hickman and McLean, 1990; Marshall, 1983, 1995). *Thoristella chathamensis profunda* Dell, 1956 is based on juveniles of the calliostomatid *Calliostoma (Maurea) blacki* (Powell, 1950) (Marshall, 1995).

Thoristella chathamensis (Hutton, 1873)
(Figs 17-30, 35-37, 39)

Polydonta chathamensis Hutton, 1873: 36
Anthora chathamiensis [sic].- Hutton, 1878: 31
Anthora chathamensis.- Hutton, 1880: 94.
Trochus (Coelotrochus) chathamensis.- Hutton, 1884: 359.
Trochus chathamensis.- Pilsbry, 1889: 43; Suter, 1897: 260.
Trochus (Infundibulum) oppressus.- Suter, 1897: 261 (in part).
Trochus (Infundibulum) oppressus dunedinensis Suter, 1897: 261. New synonym.
Calliostoma aucklandicum Smith, 1902: 207, pl. 24, fig. 5; Suter, 1913: 144, pl. 33, fig. 15. New synonym.
Trochus (Infundibulum) chathamensis.- Suter, 1913: 107, pl. 33, fig. 2.
Trochus (Infundibulum) chathamensis dunedinensis.- Suter, 1913: 108.
Thoristella chathamensis.- Iredale, 1915: 436; Odhner, 1924: 12; Finlay, 1928: 237.
Thoristella chathamensis dunedinensis.- Iredale, 1915: 436; Finlay, 1926: 351, 370, pl. 18, fig. 15, 16; Powell, 1955: 51; Powell, 1979: 59.
Thoristella aucklandica.- Iredale, 1915: 436; Odhner, 1924: 12.
Thoristella chathamensis benthicola Finlay, 1926: 350, 370; Cernohorsky, 1972: 236, fig. 7.
Thoristella chathamensis chathamensis.- Finlay, 1926: 370; Powell, 1979: 59, pl. 17, fig. 16.
Thoristella chathamensis aucklandica.- Finlay, 1926: 370; Powell, 1933: 35; Powell, 1955: 50; Powell, 1979: 59, pl. 17, fig. 7.
Thoristella chathamensis cookiana Powell, 1934: 154, pl. 22, fig. 10, 11. New synonym.
NOT *Trochus chathamensis*.- Hutton, 1893: 69, pl. 8, fig. 74a-c = *Trochus tiaratus* Quoy and Gaimard, 1834.

Description (Chatham Islands material only): Shell up to 9.2 mm wide, as wide or (typically) wider than high, thick, conical, spire weakly gradate or pagodiform, base of narrow umbilicus infilled with callous. Colour: protoconch white; first 2 teleoconch whorls cream with 3 narrow, red spiral bands, abapical band partly covered by succeeding whorls, median spiral alone persisting onto third whorl and remaining red or becoming olive or brown; third and subsequent whorls greenish white or white with olive or brown (fading to red in beach shells) irregular axial maculations and spots, peripheral bulge alternately maculated, basal spirals alternately streaked; umbilicus and columella porcellanous white. Protoconch 300 μm wide, smooth, tip tightly pinched. Teleoconch of up to 5 whorls, first 2 whorls convex, subsequent whorls becoming weakly convex or almost flat above peripheral bulge; periphery tightly rounded; peripheral bulge varying from very weak to strong and flange-like, summit smooth or gently undulant, whorls inserted against its abapical side; base weakly convex. Spire and base sculptured throughout with narrow, smooth spiral cords, and fine, crisp, crowded, interstitial collabral lamellae; last few spire whorls with or without addition of low, broad, rounded axial folds on adapical half. Spiral cords multiplying by intercalation, numbering 12-14 on adult penultimate whorl, summits more or less flat. Umbilical wall smooth. Columella thick, smooth, almost straight, inserted against rim of umbilicus. Aperture trapezoidal. Outer lip simple, rim thin, thickened within, strongly thickened abapically.

Type data:
Polydonta chathamensis: Original type material lost (Marshall, 1996), type locality Chatham Islands;
Trochus oppressus dunedinensis: Lectotype (Boreham, 1959) NZGS TM434, Dunedin Harbour, under stones;
Calliostoma aucklandicum: Lectotype (the originally figured syntype here selected, 7.50 x 8.00 mm) BMNH 1902.5.16.90 and 5 paralectotypes BMNH 1902.5.16.91-95, Auckland Islands, 18 m;
Thoristella chathamensis benthicola: Holotype AIM TM70764, off Otago Heads, 110m;
Thoristella chathamensis cookiana: Holotype AIM AK70765, Island Bay, Wellington, under stones.

Other material examined: About 1000 specimens in 110 lots NMNZ.

Distribution: (Fig. 39). Southern North Island, South Island east coast, Fiordland, and Stewart, Snares, Auckland, Campbell, Antipodes, Bounty and Chatham Islands, southern New Zealand, 0-360 m; taken alive at low tide (under stones) to 100 m on hard substrata.

Remarks: Thoristella chathamensis is the most variable trochid living in the New Zealand region. Teleoconch sculpture consists of fine to strong spiral cords that number eight to fourteen on the adult penultimate whorl (including abapical spiral, summit of which is more or less covered by succeeding whorls); fine, crowded to strong and well-spaced interstitial collabral lamellae; with or without the addition of weak to strong rounded axial folds on the spire.

Specimens from the littoral and shallow sublittoral tend to be more broadly conical, and to have finer, more numerous spiral cords, finer and closer axial lamellae, and weaker axial costae (or none) than specimens from deeper water. The colour pattern may comprise spiral bands on the first two teleoconch whorls and irregular axial maculations, spots and spiral streaks thereafter, or solid spiral bands throughout. The shell ranges from slightly higher to (typically) markedly wider than high, and the periphery may be simply angulate or very prominently flanged. There is complete intergradation between the extremes both within many populations and from one population to another. Adult specimens range from 4.70 to 10.0 mm in width (Stewart Island), the largest specimens seen being from Stewart Island and the Auckland Islands (width up to 10.0 mm).

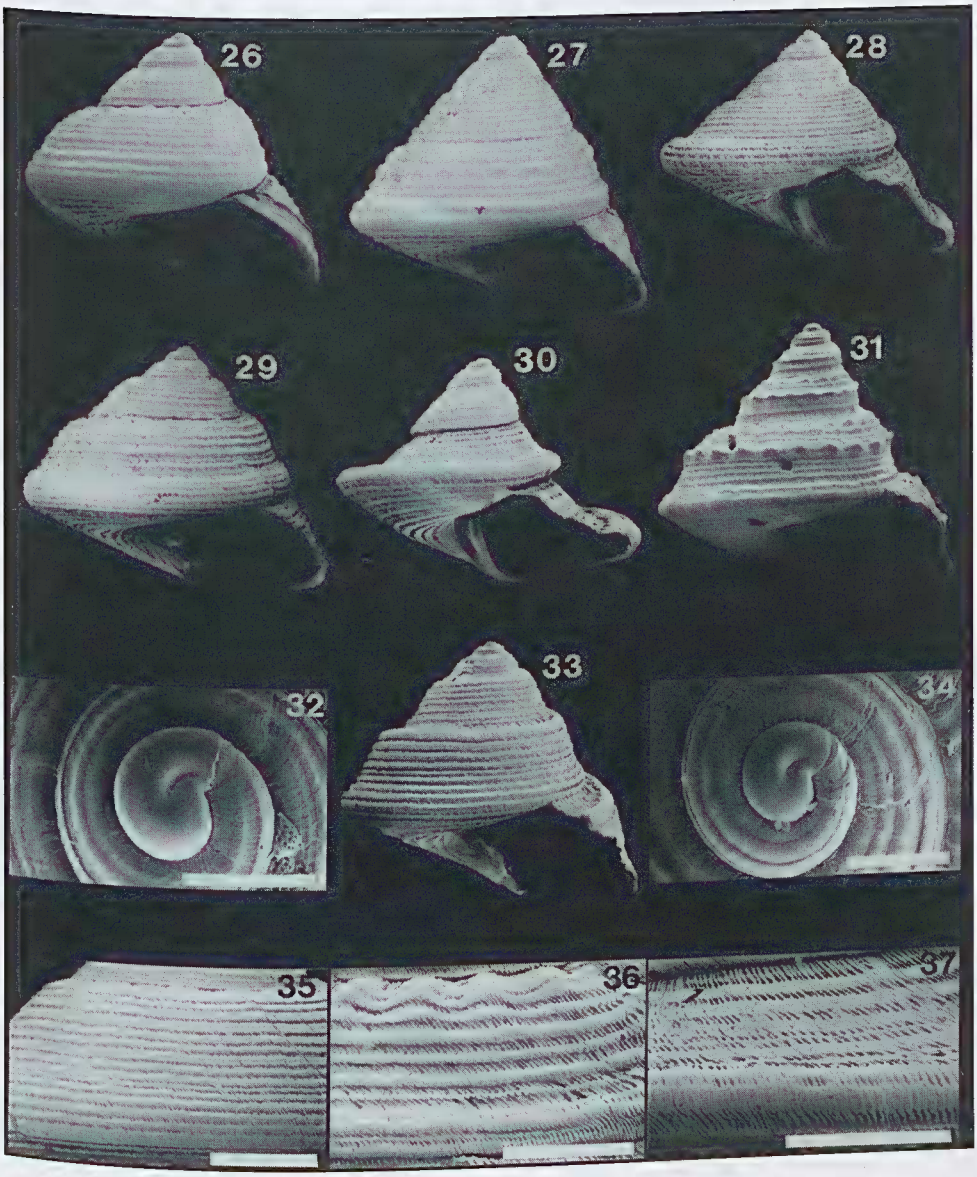
Specimens from the Chatham Islands have the strongest axial colour patterns and simple to strongly flanged peripheries, and the axial costae are weak or absent (Figs 17, 18).

The most stable isolated population occurs off the Bounty Islands, where the species is abundant. All of these shells lack axial folds, and are low, unusually small (width up to 5.7 mm), and spirally banded, with an exceptionally strong, upturned peripheral flange on the last adult whorl (Figs 30, 37).

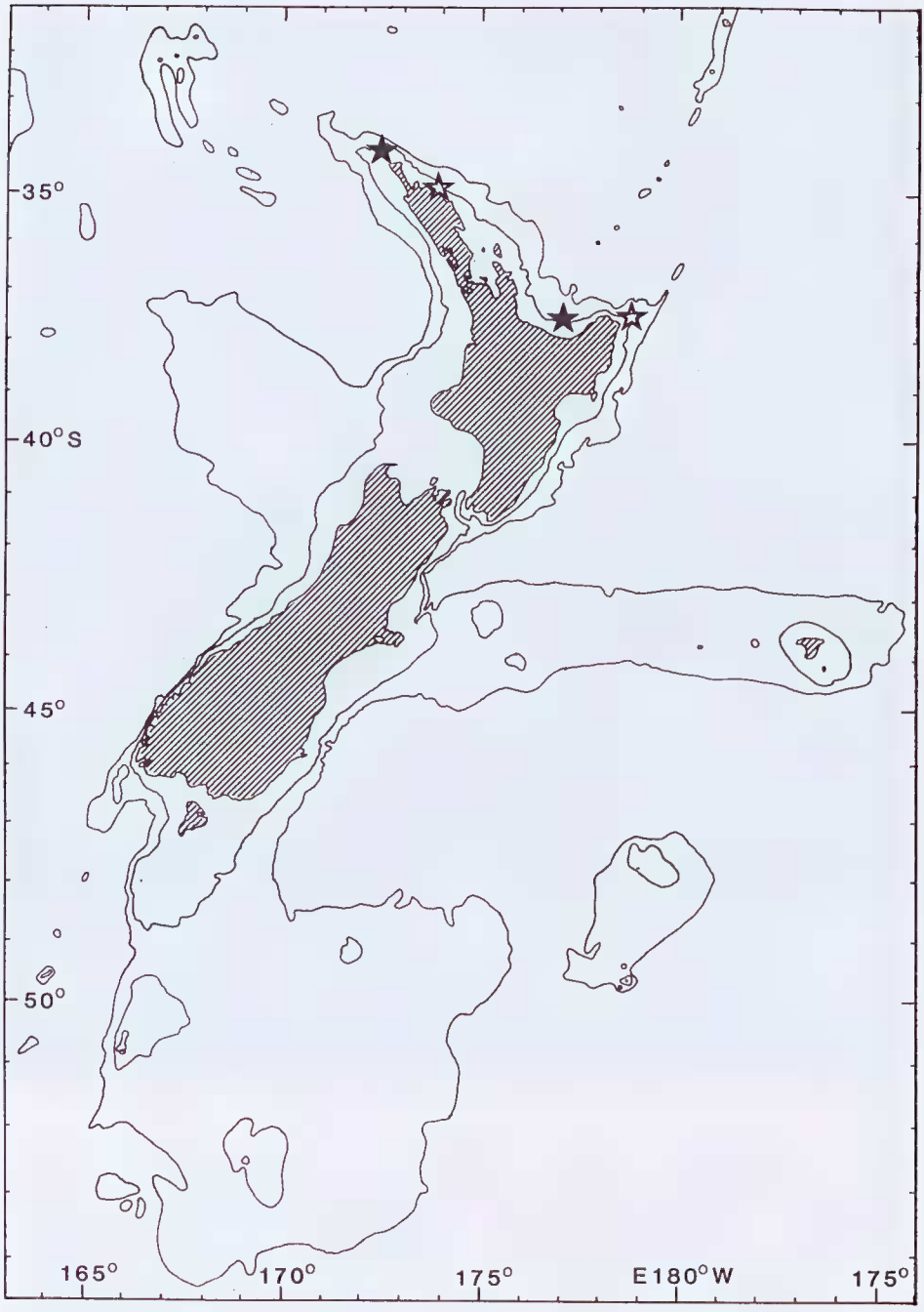
Specimens from the Antipodes Islands are spirally banded, have moderate peripheral bulges and weak axial folds, and are similar to Auckland Islands shells (Fig. 29).

Specimens taken living from the littoral zone and as beach shells at the Auckland Islands (Figs 26-30) resemble the Bounty Islands form in colour and colour pattern, but the peripheral bulge is not as prominent though moderate to strong, and axial costae may be present or absent. Specimens taken there by dredging have higher spires, and weak to moderate peripheral bulges, most having stronger axial costae though some lack them (Fig. 28). The few (littoral) specimens seen from Campbell Island resemble Auckland Islands shells, and all have axial costae and a moderate peripheral bulge.

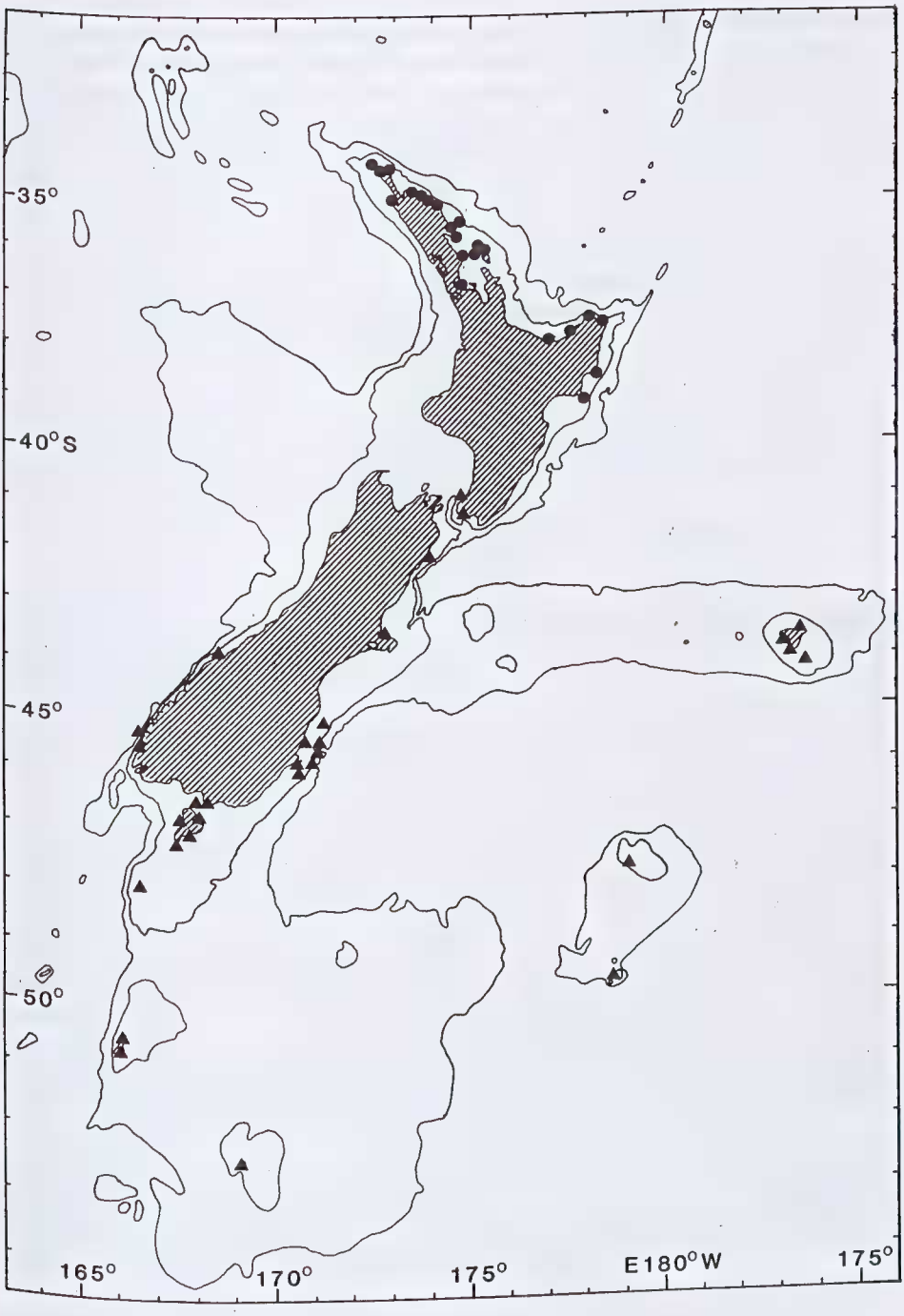
All specimens seen from the southern North Island, including the holotype of *T. chathamensis cookiana,* lack axial costae (Fig. 19), and this is the characteristic littoral and shallow sublittoral form from the South Island east coast, Fiordland, Stewart Island, and the Chatham Islands. A weakly costate form occurs in the littoral at Shag Point, Otago, and *T. chathamensis dunedinensis* is based on weakly and non-costate littoral specimens from Dunedin. The most strongly costate forms occur living at 33-100 m off Otago Peninsula, in Foveaux Strait, and off Stewart Island, and include the holotype of *T. chathamensis benthicola* (Fig. 22). There is complete intergradation between costate and non-costate extremes in extensive collections from Fiordland, and Stewart, Snares, Auckland and Chatham Islands, and between specimens with flanged and simple peripheries in Fiordland and off Otago and Snares, Auckland, and Chatham islands. Powell (1955) considered that all specimens from Bounty, Auckland and Campbell islands were consubspecific (*T. chathamensis aucklandica*). There seems to be little doubt, however, that all of the material examined represents a single highly polymorphic species.



Figures 26-37.
Shells of *Thoristella* species. **26-30.** *T. chathamensis* (Hutton). **26.** Laurie Harbour, Auckland Islands, 7 m, M.45297 (5.40 x 6.30 mm). **27.** Tagua Bay, Auckland Islands, 18m, M.8369 (7.20 x 7.80 mm). **28.** Derry Castle Reef, Enderby Island, Auckland Islands, beach, M.49632 (4.05 x 5.80 mm). **29.** Ringdove Bay, Antipodes Islands, M.29188 (6.00 x 7.60 mm). **30.** Off Proclamation Island, Bounty Islands, 39 m, M.119722 (3.50 x 4.85 mm). **31, 32.** *T. rex* n. sp., off Northeast Island, Three Kings Islands, 102 m. **31.** Holotype, M.127365 (4.25 x 4.90 mm). **32.** Protoconch of paratype M.34257. **33,34.** *Thoristella oppressa* (Hutton). **33.** Taurikura Bay, Whangarei Heads, littoral, M.18871 (4.55 x 5.30 mm). **34.** (protoconch). N of Cape Reinga, 88 m, M.35911. **35-37.** *Thoristella chathamensis*, details of teleoconch sculpture of specimens at Figures 19, 25 and 30 respectively. Scale bars 32, 34 = 330 μm, others = 1 mm.



Figures 38.
Map of New Zealand region showing distributions of *Trochus* and *Thoristella* species. 200 and 1000 metre contours indicated. **38.** *Trochus camelophorus* (☆ and ★) and *Thoristella carinata* n. sp. (★).



Figures 39.
Map of New Zealand region showing distributions of *Trochus* and *Thoristella* species. 200 and 1000 metre contours indicated. **39.** *Thoristella oppressa* (Hutton) (l) and *Thoristella chathamensis* (Hutton) (▲).

Despite ranging as far north as the southern North Island, and being common living to 100 m depth off Otago Peninsula, *T. chathamensis* has not been obtained living sublittorally north of Oamaru, despite extensive sampling of seemingly favourable substrata. Why it does not isotherm track sublittorally in the northernmost part of its range is unclear. It is the only *Thoristella* species occurring south of Cook Strait. Shells of this species are commonly encrusted with sabellid polychaetes of the genus *Spirorbis*.

Colonial Museum (now Museum of New Zealand) lot 193, listed by Hamilton (1906) as "Chatham Islands (Types?)", is no longer extant (Marshall, 1996). The only other early specimens remaining in the collection are six shells labelled "N.Z. Coll. A. Hamilton" that had originally been gummed to a tablet (NMNZ M.515). The original label is no longer extant. According to Hamilton (1906), this material was added to the collection after 1904 so they cannot be type specimens.

Thoristella chathamensis profunda Dell, 1956 is based on juveniles of the calliostomatid *Calliostoma (Maurea) blacki* (Powell, 1950) (Marshall, 1995).

Thoristella rex n. sp.
(Figs 13, 31, 32)

Description: Shell up to 5.00 mm wide, slightly wider than high, of moderate thickness, umbilicus narrow. Colour: Protoconch translucent white; spire on first 1.5 teleoconch whorls traversed by regular, arcuate pink bands on white or pinkish white ground; subsequent spire and base pink or pale olive, irregularly axially banded and spotted white; umbilicus porcellanous white. Protoconch 330 μm wide, smooth, tip tightly pinched. Teleoconch of up to 4.5 whorls, periphery angulate, base weakly convex. First 1.5 whorls convex, subsequent spire whorls with median nodular angulation and tightly rounded, weakly undulant peripheral bulge. Sculpture consisting of spiral cords that multiply by intercalation, low, rounded axial pleats in narrow subsutural zone, and fine, crisp, crowded, interstitial axial riblets. Spiral cords crisp, narrow, interspaces wider, abapical spiral partly covered by succeeding whorls; 4 on first spire whorl, smooth, similar; multiplying to 9 on subsequent whorls, median and (in holotype) subsutural spiral becoming nodular; 10 smooth, similar cords on base, another on outer part of smooth, concave umbilicus (holotype). Columella thick, strongly so adapically before retracting to insertion. Outer lip simple, thin at rim, thickened within, strongly so abapically. Animal unknown.

Type data: Holotype NMNZ M.127365 and 5 immature paratypes NMNZ M.34257, 34°08.5'S, 172°11'E, off Northeast Island, Three Kings Islands, dead, 102 m, 18 February 1974, r.v. Acheron. Paratype: 33°59.9'S, 171°45.3'E, Middlesex Bank, NW of Three Kings Islands, dead, 186-196 m, 31 January 1981, r.v. Tangaroa (1 subadult, M.127363).
Other material examined: 78633. 34°20.4'S, 171°48.2'E, 37 km SW of Great Island, Three Kings Islands, 440 m, 21 June 1978, r.v. Tangaroa (fragment, M.131601).

Distribution: (Fig. 13). Off Three Kings Islands, northern New Zealand, 102-440 m, from comminuted bryozoan/shell substrata (shells only).

Remarks: Thoristella rex resembles strongly sculptured forms of the type species (*T. chathamensis*) in having a subsutural zone of axial pleats on the teleoconch, but differs from all forms of that species in having axial instead of spiral colour bands on the early teleoconch whorls, and from this and other *Thoristella* species in having a nodular median angulation on the spire. A specimen represented by a fragment of a last adult whorl is estimated to have been 6.9 mm wide, suggesting that the holotype is subadult.

Etymology: King (Latin).

Thoristella oppressa (Hutton, 1878)
(Figs 33, 34, 39)

Gibbula oppressa Hutton, 1878: 34; Pilsbry, 1889: 232, pl. 40, fig. 4, 5; Hutton, 1880: 102; Hutton, 1883a: 124, pl. 14, fig. m; Hutton, 1884: 364.
Trochus (Infundibulum) oppressus.- Suter, 1897: 261 (in part = *T. chathamensis*); Suter, 1913: 108, pl. 38, fig. 2, 2a (in part = *T. chathamensis*).
Thoristella oppressa.- Iredale, 1915: 436; Powell, 1979: 60, pl. 17, fig. 8.
Thoristella chathamensis oppressa.- Finlay, 1926: 370.

Type data: Type material apparently lost, not traced at Otago Museum where it should presumably have been: "Auckland".

Other material examined: Several hundred specimens in 50 lots NMNZ.

Distribution: (Fig. 39). Three Kings Islands (uncommon) and north-eastern North Island (common) as far south as Mahia Peninsula, New Zealand, living under stones and on kelp holdfasts at low tide to 15 m depth, locally living as deep as 88 m (off Cape Reinga, NMNZ M.35911).

Remarks: Compared with shallow water forms of *Thoristella chathamensis* without nodules, which it much resembles, *T. oppressa* differs in that all but the earliest teleoconch whorls are shouldered, in that the spiral cord at the shoulder angulation becomes much broader than the others, and in that early teleoconch whorls are axially instead of spirally banded. Unlike forms of *T. chathamensis*, *T. oppressa* is never nodular or axially costate, and there are no discernible differences between littoral and deep-living populations. The two species are allopatric, with *T. oppressa* unknown south of Mahia Peninsula, and the nearest populations of *T. chathamensis* at Wellington. I am unable to detect any differences in shell morphology colour or colour pattern between specimens from the Three Kings Islands and the North Island.

Suter's (1897, 1913) record of this species from the Chatham Islands is based on the non-costate form of *T. chathamensis*.

Thoristella carmesina (Webster, 1908)
(Figs 40, 41, 43, 48, 60)

Trochus carmesinus Webster, 1908: 256: pl. 20, fig. 16-18.
Monilea carmesina.- Suter, 1913: 140, pl. 38, fig. 24.
Thoristella carmesina.- Finlay, 1926: 350.
Talopena carmesina.- Powell, 1974: 207; Powell, 1979: 60, pl. 17, fig. 11.

Type data: Holotype AIM AK70777, Russell, Bay of Islands.

Other material examined: 60 specimens in 20 lots NMNZ.

Distribution: (Fig. 60). North-eastern North Island, from Whangaroa to as far south as Ranfurly Bank, East Cape, northern New Zealand, 0-228 m, taken alive (by divers) under stones at 12-15 m.

Remarks: *Thoristella carmesina* differs from *T. oppressa* in lacking a shoulder angulation, in attaining larger size (width 8.00mm, cf. 6.80mm), and in having a smaller protoconch (width 300 μm, cf. 330 μm), a deeper umbilicus, weaker interstitial axial lamellae; finer, more numerous, closer spiral threads; and in that there is a shallow channel between the top of the columella and the insertion.

Powell (1974) referred this species to *Talopena* Iredale, 1918 (type species *Monilea incerta* Iredale, 1912; Recent, Kermadec Islands) because of the presence of a flexure in the columella beside the insertion. *Monilea incerta*, however, has strongly dissimilar gross facies, including a deeply perspective umbilicus, and an inner lip that is entirely different in shape and inserted on the paries. I have already indicated (Marshall, 1979) that *M. incerta* has scale-like central and lateral teeth and undoubtedly belongs in Umboniinae, and that *Talopena* may be a synonym of *Monilea* Swainson, 1840. The external anatomy, shell and radular morphology of *T. carmesina* are accordant the non-costate form of *T. chathamensis* and *T. oppressa*, and it is a perfectly typical *Thoristella* species.

Webster's (1908) record of the species from Cape Palliser is presumably based on the *cookiana* form of *T. chathamensis*.

Thoristella davegibbsi n. sp.
(Figs 42, 44, 46, 49, 60)

Description: Shell up to 6.90 mm wide, wider than high, stout, umbilicate. Colour: Protoconch white or pale green; first 1.5 whorls white or greenish white with 3 red spiral bands (abapical band partly covered by succeeding whorl); subsequent spire whorls basically green (typically), red or brown with narrow, paler and darker, wavy, irregular axial bands and spots; predominant colour in some specimens abruptly changing from green to brown or from green to brown to green. Umbilicus and columella porcellaneous white. Interior nacreous, a narrow whitish band immediately within outer lip, rim of which shows external pigmentation. Protoconch 300-320 μm wide, smooth, tip pinched. Teleoconch of up to 4.20 rather regularly expanding whorls, last part of last adult whorl slightly contracted and descending; periphery roundly angulate, weakly bulging; base weakly convex. First 2 spire whorls strongly convex; subsequent whorls weakly convex, almost flat over abapical 2 thirds. Sculpture of numerous

fine, flattened spiral threads and finer, crisp, crowded interstitial collabral lamellae. Wall of umbilicus smooth. Columella thick, smooth, near adapical extremity distinctly and rather suddenly retracted to insertion, straight abapically. Outer lip simple, rim thin; thickened within, more strongly so abapically.

Type data: Holotype NMNZ M.100394, Southeast Bay, Great Island, Three Kings Islands, alive under stones, 18-22 m, May 1988, scuba, D. Gibbs. Paratypes: 33°57.4'S, 172°19.4'E, King Bank, N of Three Kings Islands, dead, 128-123 m, 1 February 1981, r.v. Tangaroa (3, M.72052); 34°10'S, 172°08'E, off Princes Rocks, Three Kings Islands, dead, 14 m, 4 January 1976, scuba, A. Watson (2, M.127355); 34°10'S, 172°08'E, outer Southeast Bay, Great Island, Three Kings Islands, dead, 55 m, 18 February 1974, r.v. Acheron (3, M.33865); Southeast Bay, Great Island, dead, 12 m, 2 February 1993, scuba F. Brook (1, M.117433); SW corner of Southeast Bay, Great Island, alive under stones, 15 m, 21 December 1976, scuba R.C. Willan (4, R.C. Willan colln); reef between Great Island and Farmer Rocks, dead, 33 m, 17 February 1986, scuba, G.S. Hardy (1, M.94041); off N face of Hinemoa Island, Three Kings Islands, dead, 23 m, 11 February 1986, scuba, G.S. Hardy (1, AMS; 35, M.112544); off NE point of Great Island, alive, 4 m, 14 February 1986, scuba F. Brook (1, M.109283); 34°11'S, 172°03'E, off West Island, Three Kings Islands, dead, Elingamite wreck, 37 m, 16 March 1981, airlifter K. Tarlton (5, M.127356); 34°21'S, 172°37'E, N of Cape Reinga, alive, 88 m, 19 February 1974, r.v. Acheron (5, M.59507).

Other material examined: (54 specimens). 35°27'S, 174°44'E, Northern Arch, Te Araara Point, Poor Knights Islands, dead, 50 m, April 1977, scuba, A. Penniket (30, M.127409); 35°28'S, 174°44'E, Middle Arch, Poor Knights Islands, dead, 30 m, 18 June 1981, scuba, K. Burch (1, M.119416); Middle Arch, dead, 15 m, 1 August 1976, A. Penniket (3, R.C. Willan colln). 35°29'S, 174°44'E, Riko Riko Cave, Aorangi Island, Poor Knights Islands, dead, 30 m, 4 February 1980, scuba, A. Penniket (5, M.127417); 35°29'S, 174°44.5'E, South Harbour, Aorangi Island, dead, 25 m, 21 April 1977, scuba, A. Penniket (15, M.127413).

Distribution: (Fig. 60). Off Three Kings Islands, Cape Reinga, and Poor Knights Islands, northern New Zealand, 4-128 m on rocky ground, taken alive at 4-88 m. Specimens taken by divers were living under stones.

Remarks: Compared with *Thoristella carmesina*, which it much resembles, *T. davegibbsi* differs in having spiral instead of axial red colour bands on the first 1.5 teleoconch whorls (Figs 40, 42), slightly but distinctly weaker spiral cords at equivalent stages of growth, and a narrower and shallower umbilicus. *T. davegibbsi* differs further in attaining smaller size (width up to 6.90 mm, cf. 8.00 mm). The basic colour of the spire after the first 1.5 teleoconch whorls in both species is variable, though in *T. davegibbsi* it is green (typically), brown or (rarely) red in specimens from the Three Kings Islands, and brown in most specimens from off the Poor Knights Islands. Equivalent whorls in *T. carmesina* are red, or have a strong red component in their colour patterns.

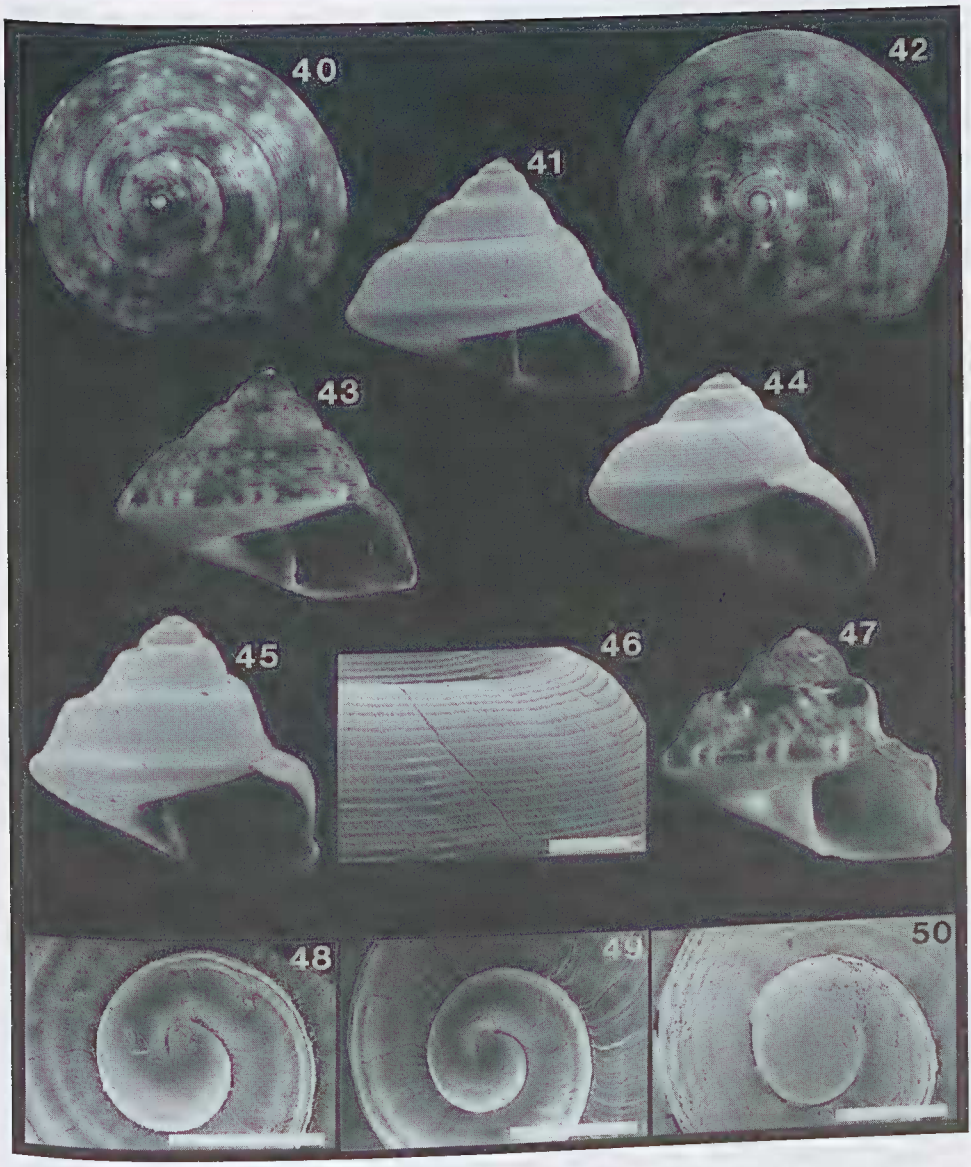
T. davegibbsi and *T. carmesina* appear to be allopatric. *T. carmesina* has not been recorded from the Poor Knights Islands where *T. davegibbsi* is not uncommon, yet *T. carmesina* but not *T. davegibbsi* is recorded elsewhere off the north-eastern North Island. *T. davegibbsi* is the only New Zealand endemic mollusc known with this distribution pattern.

Etymology: Named in honour of the late Dave Gibbs (1954-1995), good friend and outstanding collector.

Thoristella polychroma n. sp.
(Figs 13, 45, 47, 50)

Description: Shell up to 5.95 mm wide, wider than high, rather thick, stout, glossy, narrowly umbilicate. Colour: Protoconch yellow; spire and base on first 1.5 teleoconch whorls pinkish white, traversed by similar, evenly spaced, narrow, arcuate, bright pink collabral bands; subsequent spire whorls with irregular, wavy axial bands between large, irregular subsutural maculations and smaller, irregular peripheral maculations in shades of dull pink or red on a white or (predominantly) greenish white ground. Adult base predominantly creamy white, central part traversed by narrow, pale pink, irregular axial bands, some of which coalesce at inner side of zone. Umbilicus and columella porcellanous white, interior of outer lip rim showing external pigmentation, opaque nacreous white within. Protoconch 430 μm wide, smooth, tip broadly rounded. Teleoconch of up to 4.0 regularly expanding whorls, last part of last adult whorl contracted and descending; periphery roundly angulate, base almost flat. First 1.5 spire whorls rather evenly convex; on subsequent whorls gently sloping flat or weakly concave subsutural ramp with tightly rounded rim, flat or weakly concave sides, and rounded peripheral bulge. Sculpture of low spiral cords and fine collabral growth lines. Spiral cords weak on spire, only adapical margins sharply defined, about 7 of similar size spread across first 1.3 spire whorls, narrower and more crisply defined abapically; on subsequent whorls absent from ramp, adapical third of side and peripheral bulge; 8 or 9 stronger cords on base. Wall of umbilicus concave, smooth or with few obscure spiral lines. Columella thick, smooth, strongly retracted from rounded adapical boss to insertion. Outer lip simple, rim thin, thicker within, strongly so abapically.

Type data: Holotype NMNZ M.134500 and 28 paratypes (1 AMS, 27 NMNZ), off N face of Hinemoa Island, Three Kings Islands, alive, 23 m, 11 February 1986, scuba, G.S. Hardy. Paratypes: 34°10′S, 172°08′E, off Princes Rocks, Three Kings Islands, dead, 14 m, 4 January 1976, scuba, A. Watson (2, M.49800); 34°10′S, 172°08′E, off Southwest Island, Three Kings Islands, dead, 33 m, 3 January 1976, scuba, A. Watson (5, M.54015); off Hinemoa Island, dead, 18 m, 17 January 1985, scuba F. Brook (3, M.117430); reef between Great Island and Farmer Rocks, Three Kings Islands, dead, 33 m, 17 February 1986, scuba, G.S. Hardy (20, M.93950); 34°11′S, 172°03′E, off West Island, Three Kings Islands, Elingamite wreck, dead, 37 m, 16 March 1981, coll. K. Tarlton (27, M.127361); 34°21′S, 172°37′E, N of Cape Reinga, dead, 88 m, 19 February 1974, r.v. Acheron (1, M.59507)



Figures 40-50.
Shells of *Thoristella* species. **40,41,43,48.** *Thoristella carmesina* (Webster). **40,43.** Maori Rocks, off Fanal Island, Mokohinau Islands, 15 m, M.87323 (5.00 x 6.35 mm). **41.** Off Henry Island, Whangaruru, 12m, M.25935 (6.50 x 7.90 mm). **48.** Protoconch, off Ruamahua-nui Island, Aldermen Islands, 38 m, M.112759. **42,44,46,49.** *T. davegibbsi* n. sp. **42.** Southeast Bay, Great Island, Three Kings Islands, 12 m, paratype, M.117433 (width 6.50 mm). 44,46 (detail). Holotype, Southeast Bay, Great Island, Three Kings Islands, 18-22 m, M.100394 (4.15 x 5.90 mm). **49.** Protoconch of paratype, N of Cape Reinga, 88 m, M.59507. **45,47,50.** *T. polychroma* n. sp. **45,50.** (protoconch). Off Hinemoa Island, Three Kings Islands, 23 m, holotype, M.134500 (3.95 x 4.30 mm). **47.** Off Hinemoa Island, Three Kings Islands, 23 m, paratype, M.112536 (2.60 x 3.65 mm). Scale bar 46 = 500 μm, others = 330 μm.

Remarks: Thoristella polychroma most closely resembles *T. oppressa* in shape, but differs markedly in colour and colour pattern, and in that the protoconch is much larger (width 430 μm, cf. 330 μm), with a broadly rounded instead of pinched tip. The enlarged tip on the protoconch suggegsts that *T. polychroma* has a different type of larval development from other *Thoristella* species: perhaps it is a larval brooder. *T. polychroma* and *T. oppressa* are sympatric north of Cape Reinga.

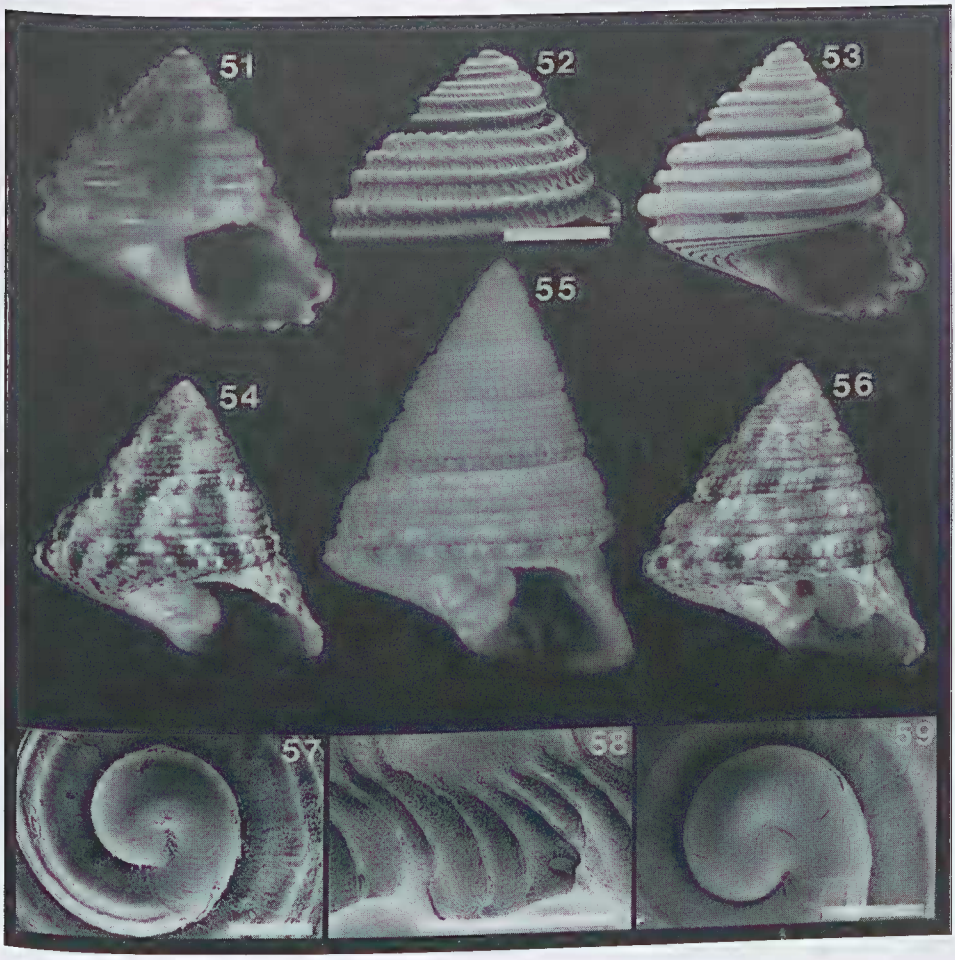
Etymology: Many-coloured (Greek).

Thoristella carinata n. sp.
(Figs 38, 51, 53, 57)

Description: Shell up to 5.75 mm wide, slightly wider than high, strong, spire evenly and broadly conical, narrowly umbilicate. Colour: protoconch white; spire on first 2 teleoconch whorls opaque creamy or pinkish white, spiral cords pink with small white spots; subsequent whorls typically pink, variably and irregularly spotted and axially banded in paler shades or white, last whorl in some specimens with irregular olive-green and/or brown axial maculations on creamy white ground. Base pink, spiral cords spotted darker shades, area between summits of outer basal spiral and abapical fourth spire spiral typically creamy white, umbilicus porcellanous white. Protoconch 330 μm wide, smooth, tip tightly pinched. Teleoconch of up to 4.75 flattened whorls, suture appearing deeply channelled because of strength of spiral sculpture, periphery tightly rounded, base weakly convex; sculptured with prominent smooth, spiral cords. Spiral cords numbering 4 on all spire whorls, and 5, 6 or occasionally 7 on base, abapical third spiral peripheral, summit of fourth (abapical) spiral partly covered by succeeding whorls. Spire spirals all similar and rounded in section on first 2 whorls; thereafter first(adapical) and third spirals enlarging more rapidly than others with adapical spiral strongest, all subquadrate in section with broadly rounded summits and concave sides, interspaces about as broad as second spiral. Basal spirals similar throughout, rounded, transforming to resemble adult spire spirals in section on last adult whorl. Umbilicus narrow, inner part infilled by columella, rim tightly rounded, concave outside columella. Columella strong, rounded, weakly protracted from insertion to low adapical swelling, almost straight abapically. Outer lip simple, rim thin, thickened within. Animal unknown (only 1 live taken juvenile available).

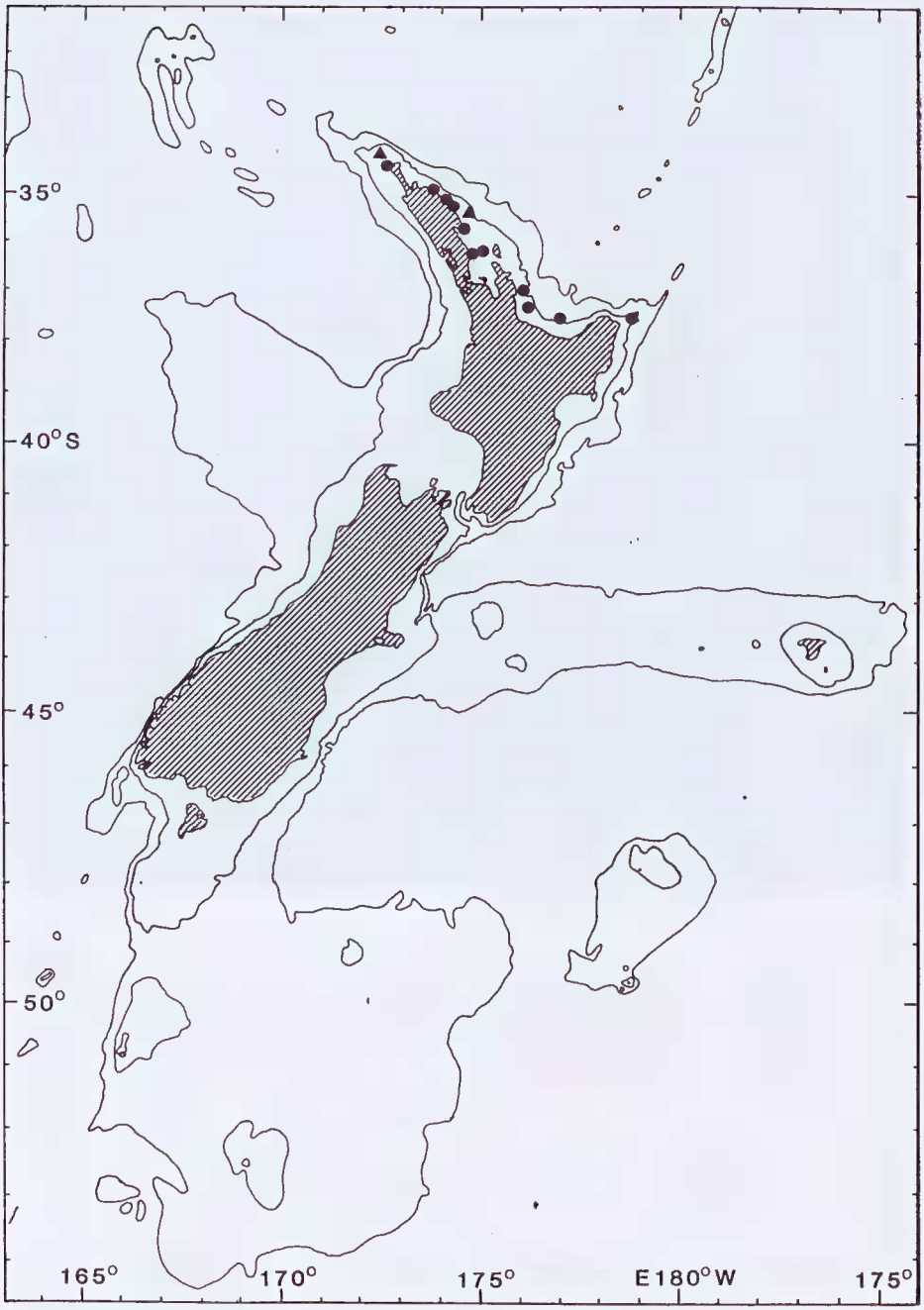
Type data: Holotype NMNZ M.127349 (5.45 x 5.75 mm, 4.75 teleoconch whorls) and 54 paratypes M.127350: 34°11'S, 172°03'E, off West Island, Three Kings Islands, in gravel from Elingamite wreck, 37 m, 16 March 1981, airlifted K. Tarlton. Paratypes: Reef between Great Island and Farmer Rocks, Three Kings Islands, 33 m, 17 February 1986, scuba, G.S. Hardy (90, M.93948).

Other material examined: (several hundred specimens NMNZ). 33°57.0'S, 171°45.4'E, Middlesex Bank, NW of Three Kings Islands, dead, 98-103 m, 31 January 1981, r.v. Tangaroa (5, M.127382); 33°57.0'S, 172°19.0'E, King Bank, N of Three Kings Islands, dead, 128 m, 1 February 1981, r.v. Tangaroa (3, M.127379);

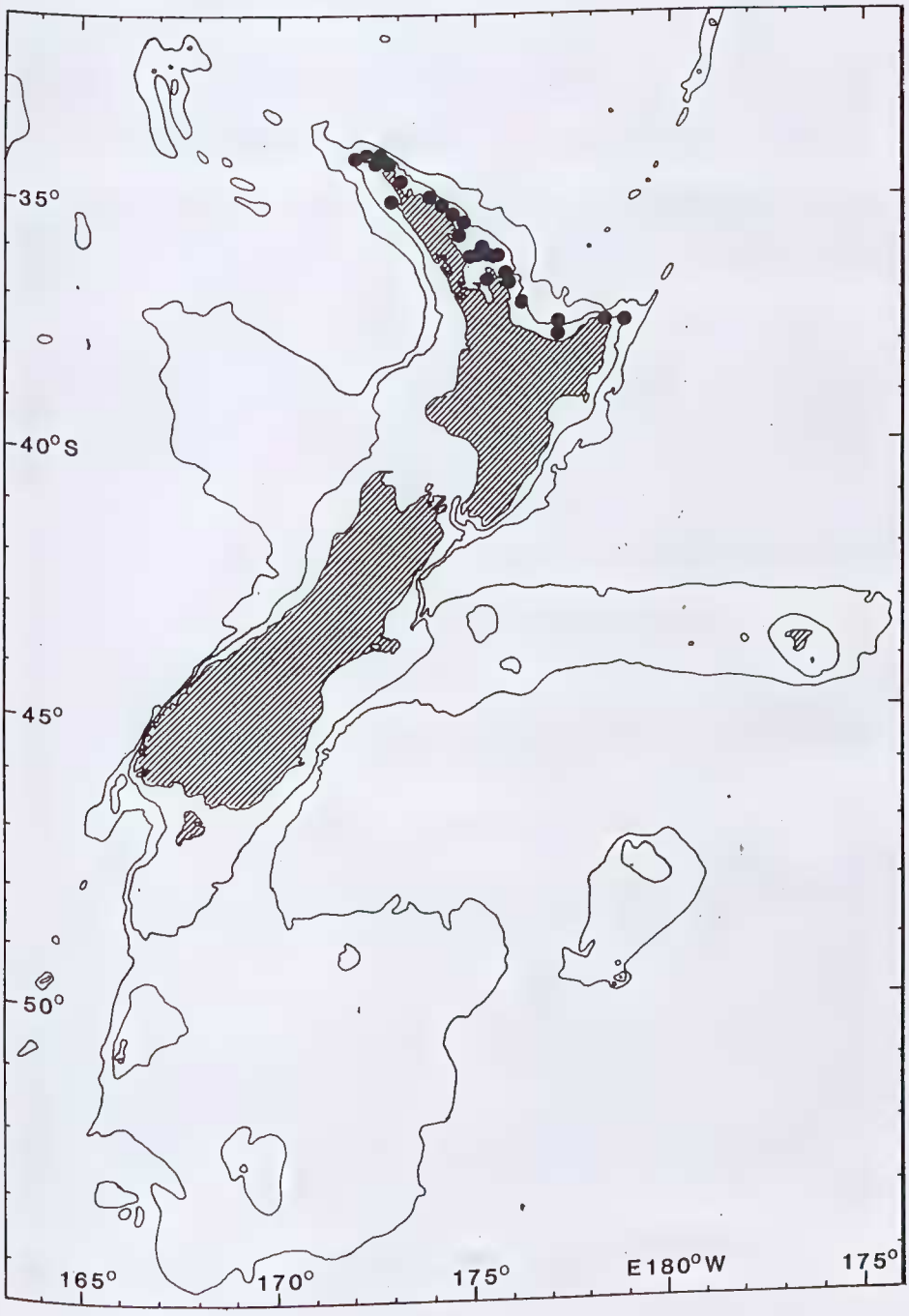


Figures 51-59.
Shells of *Thoristella* and *Clanculus* species. **51,53,57.** *T. carinata* n. sp. **51.** Reef between Great King Island and Farmer Rocks, Three Kings Islands, 33 m, paratype, M.93948 (4.00 x 4.45 mm). **53.** Off West Island, Three Kings Islands, 37 m, holotype, M.127349 (5.40 x 5.80 mm). **57.** Protoconch, off Hinemoa Island, Three Kings Islands, 23 m, M.112537. **52,54-56, 58,59.** *C. peccatus* (Finlay). 52,58 (detail), 59 (protoconch). Juvenile, Southeast Bay, Great Island, Three Kings Islands, 55 m, M.33824. **54.** Moturua Island, Bay of Islands, 9m, M.117851 (11.0 x 11.0 mm). **55.** Poor Knights Islands, 11-13 m, M.100392 (15.0 x 11.0 mm). **56.** Cape Rodney, 16m, M.117852 (12.0 x 11.4 mm). Scale bar 52 = 1 mm, others = 170 μm.

33°57.4'S, 172°19.4'E, King Bank, dead, 128-123 m, 1 February 1981, r.v. Tangaroa (many fragments, M.72054); 34°10'S, 172°08'E, off Southwest Island, Three Kings Islands, dead, 33 m, 3 January 1976, scuba, A. Watson (4, M.54019); 34°10'S, 172°08'E, off Princes Rocks, Three Kings Islands, dead, 14 m, 4 January 1976, scuba, A. Watson (3, M.49905); off N face of Hinemoa Island, Three Kings Islands, alive, 23 m, 11 February 1986, scuba, G.S. Hardy (46, M.112537); 34°10'S, 172°08'E, outer Southeast Bay, Great Island, Three Kings Islands, dead, 55 m, 18



Figures 60
Map of New Zealand region showing distributions of *Thoristella* and *Clanculus* species. 200 and 1000 metre contours indicated. **60.** *T. carmesina* (Webster) (●) and *T. davegibbsi* n. sp. (▲).



Figures 61
Map of New Zealand region showing distributions of *Thoristella* and *Clanculus* species. 200 and 1000 metre contours indicated. **61.** *C. peccatus* (Finlay).

February 1974, r.v. Acheron (3, M.127378); off Princes Rocks, dead, 15 m, 2 December 1983, scuba G.S. Hardy and A.L. Stewart (2, M.127380); Arch Pinnacle, Three Kings Islands, dead, 40 m, 10 March 1983, scuba F. Brook (1, M.109335); 34°21'S, 172°37'E, N of Cape Reinga, dead, 88 m, 19 February 1974, r.v. Acheron (1, M.35910); 37°33.8'S, 176°59.0'E, Rungapapa Knoll, WNW of White Island, Bay of Plenty, dead, 188-228 m, 20 January 1979, r.v. Tangaroa (4, M.127381).

Distribution: (Fig. 38). Off Three Kings Islands and Rungapapa Knoll, Bay of Plenty, northern New Zealand, 14-228 m, taken alive (juvenile) at 23 m, common on rocky ground.

Remarks: Although this species is clearly referable to Trochini on the basis of insertion of the columella into the umbilicus, the teleoconch sculpture is very distinctive and relationships within the group are obscure. The lack of a spiral cord on the umbilical wall, infilling of the umbilicus by the columella, and small size, however, suggest that it may belong in *Thoristella*. Fragmentary specimens are up to 7.90 mm wide.

Etymology: Keeled (Latin).

Genus **Clanculus** Montfort, 1810

Clanculus Montfort, 1810: 191.
Type species (by original designation): *Trochus pharaonius* Linnaeus, 1758; Recent, Red Sea, Arabian Sea and Arabian Gulf.

Subgenus **Paraclanculus** Finlay, 1926

Paraclanculus Finlay, 1926: 351.
Type species (by original designation): *Paraclanculus peccatus* Finlay, 1926; Recent, New Zealand.

Remarks: Clanculus has been divided into a number of subgenera that are difficult to objectively define (Herbert, 1993), and most of which are of doubtful value. Nevertheless, it seems appropriate to retain *Paraclanculus* as a subgenus because its type species differs from the type species of *Clanculus* (s. str.) and *Clanculopsis* Monterosato, 1879 (type species *Trochus cruciatus* Linnaeus, 1758) in being conical instead of turbiniform, with flattened instead of convex spire whorls.

Clanculus (Paraclanculus) peccatus (Finlay, 1926)
(Figs 54-56, 58, 59, 61)

Trochus (Clanculus) ringens.- Suter, 1897: 262; Suter, 1913: 112, pl. 38, fig. 3 (not Menke, 1843).
Paraclanculus peccatus Finlay, 1926: 351, pl. 18, fig. 17; Cernohorsky, 1972: 238, fig. 9.

Clanculus (Paraclanculus) peccatus.- Powell, 1976: 83; Powell, 1979: 60, pl. 17, fig. 4.

Type data: Holotype AIM TM584, Tryphena, Great Barrier Island.

Other material examined: Several hundred specimens in 78 lots NMNZ.

Distribution: (Fig. 61). Three Kings Islands, east and west coasts of Northland, and north-eastern North Island to as far south as Ranfurly Bank, East Cape, northern New Zealand, 0-622 m, taken alive at 4-56 m from rocky substrata. Specimens taken alive by divers were living under rocks.

Remarks: Clanculus peccatus is particularly variable in colour, colour pattern and shell shape, which ranges from wider than high to higher than wide. There are typically four primary spiral cords on the spire whorls (excluding abapical spiral, summit of which is mostly covered by succeeding whorls), though specimens with five cords are not uncommon. The nodules on the spire range from hemispherical to axially elongate, and the space between the two peripheral spirals and the adapical spire spirals may be narrower or broader than each spiral. The large tooth at the base of the columella is typically biplicate, but the secondary (abapical) plication may be absent.

As suggested by Powell (1958, 1979), and confirmed by comparison of actual specimens, *Trochus (Clanculus) takapunaensis* Webster, 1906 (AIM AK70778), reputedly from Takapuna, Auckland, is based on a mislocalised example of the southern Australian species *Clanculus plebejus* (Philippi, 1851).

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Key to New Zealand Recent *Trochus, Clanculus* and *Thoristella* species (adult shells).

1. Shell more than 10 mm wide - 2
   Shell less than 10 mm wide - 5

2. Spiral cords on spire without nodules and traversed by axial riblets (Three Kings Islands and northern North Island) - *Trochus (Camelotrochus) camelophorus* (Figs 14, 16).
   Spiral cords on spire with rounded nodules - 3

3. Inner lip with strong tooth at base (Three Kings Islands and northern North Island) - *Clanculus (Paraclanculus) peccatus* (Figs 54-56).
   Inner lip without tooth at base - 4

4. Umbilical wall with 2 spiral cords, spiral cords on spire strongly nodular, periphery nodular, greenish (widely distributed) - *Trochus (Thorista) viridis* (Figs 5-8, 10).
   Umbilical wall smooth, spiral cords on spire finely nodular, periphery not nodular, whitish with brown spots (widely distributed) - *Trochus (Coelotrochus) tiaratus* (Figs 1-4).

5. No distinct axial riblets in spiral interspaces - 6
   Distinct, fine, crisp axial riblets in spiral interspaces on spire - 7

6. Spire whorls with 3 strong spiral cords with deep interspaces, not stepped, suture deeply chanelled (Three Kings Islands and rarely subtidally off northeastern North Island) - *Thoristella carinata* (Figs 51, 53).
   Spire whorls with weak spiral sculpture, strongly stepped, suture not channelled (Three Kings Islands and off Cape Reinga) - *Thoristella polychroma* (Figs 45, 47).

7. Spire whorls strongly stepped or medially angulate - 8
   Spire whorls not stepped or medially angulate - 9

8. Spire whorls strongly stepped, whorls flattened, no nodules, typically greenish, reddish axial bands on first teleoconch whorl (Three Kings Islands and North Island as far south as Mahia Peninsula) - *Thoristella oppressa* (Fig. 33).

Spire whorls with low median angulation and subsutural and median row of nodules, typically pinkish, pinkish axial bands on early teleoconch whorls (Three Kings Islands only) - *Thoristella rex* (Fig. 31).

9. Spire whorls flattened, reddish spiral bands on early teleoconch whorls (Cook Strait, South Island, Stewart Island, The Snares, subantarctic islands, and Chatham Islands) - *Thoristella chathamensis* (Figs 17-30).

Spire whorls rounded, reddish spiral or axial bands on early teleoconch whorls - 10

10. Red spiral bands on early spire whorls, typically greenish (Three Kings Islands, off Cape Reinga, and off Poor Knights Islands) - *Thoristella davegibbsi* (Figs 42, 44).

Red axial bands on early spire whorls (north-eastern North Island as far south as East Cape), typically reddish - *Thoristella carmesina* (Figs 40, 41, 43).